December, 1951 AIC-326

LIST OF PUBLICATIONS AND PATENTS (WITH ABSTRACTS) ON FREEZING PRESERVATION OF FRUITS, VEGETABLES, POULTRY, AND POULTRY PRODUCTS (1941 to 1951) of the

WESTERN REGIONAL RESEARCH LABORATORY
Albany 6, California

CONTENTS

Bureau of Agricultural and Industrial Chemistry
Agricultural Research Administration
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OBTAINING INFORMATION

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Publications and Patents on Frozen Foods
Western Regional Research Laboratory

GENERAL

AIC-46, SELECTED BIBLIOGRAPHY ON FREEZING PRESERVATION OF FRUITS AND VEGETABLES, 1920-45. Rev. No. 3, May, 1947.

CAN FROZEN FOODS HELP WIN THE WAR AND WRITE THE PEACE? H. C. Diehl, West. Frozen Foods 3(4):5-6, 8, 10, 1942.

An analysis of part that frozen foods might play in war. Strategic advantages of frozen foods, particularly saving of packaging materials such as tin.

BASIC METHODS OF PROCESSING FOOD. J. R. Matchett, U.S. Dept. Agr. Yearbook, pages 111-14, 1950-51.

Principles involved in canning, freezing, and dehydration of foods are reviewed.

TRENDS IN FREEZING PRESERVATION OF FOODS. V. D. Greaves and M. M. Boggs, Jour. Home Econ. 37(1):23-26, Jan., 1945. (With Univ. Calif.).

Analyzes trends that were manifest shortly before close of the war and treats of blanching, thawing, nutritive values, and new products including precooked foods.

AIC-35, DETERMINATION OF ASCORBIC ACID IN FRESH, FROZEN, AND DEHYDRATED FOODS. Dec., 1943.

ASCORBIC ACID. RAPID DETERMINATION IN FRESH, FROZEN, OR DEHYDRATED FRUITS AND VEGETABLES. H. J. Loeffler and J. D. Ponting, Indus. and Engin. Chem., Analyt. Ed., 14(11):846-849, Nov., 1942.

Reports that ascorbic acid can be determined quickly in fruits and vegetables, whether fresh, frozen, or dehydrated, by disintegrating the sample with dilute metaphosphoric acid in a high-speed cutter and measuring decolorizing effect of extracted ascorbic acid on indophenol dye with a photoelectric colorimeter. The ascorbic acid is distributed within the total liquid phase present, which includes water and dissolved solids originally in the sample. By using a large proportion of extractant and knowing approximate amount of liquid in sample, ascorbic acid can be determined from as little as 3 ml. of filtrate after only one extraction. By using a large amount of 1 percent metaphosphoric acid as extractant the buffering step is avoided, since the pH obtained is sufficiently low to prevent losses during blending, yet sufficiently high to prevent fading of the dye reagent.

HOW TO TEST YOUR AIR-BLAST FREEZER. E. Lowe, G. S. Smith, and O. H. Spaugh, Food Indus. 22(4):638-641, April, 1950.

Methods for testing the performance of commercial air-blast freezers, including air velocities, power consumption, air temperatures, piece-center temperatures, and other variables are described. Instruments used include not-thermocouple anemometers, special static pressure heads, and a multi-point electronic pyrometer. Readings are recorded remotely.

AN IMPROVED HEATED-THERMOCOUPLE ANEMOMETER FOR USE IN AIR-BLAST FREEZERS. E. Lowe and J. R. Hawes, Food Technol. 3(7):241-243, July, 1949.

An improvement for a heated-thermocouple anemometer was developed for use in measuring air velocity in air-blast freezers. A method was devised for adjusting calibration of each individual anemometer to fit a common calibration curve, making possible the use of several anemometers interchangeably.

A DEFROSTING INDICATOR FOR FROZEN FOODS. A. A. Andersen, Food Technol. 3(11): 357-358, Nov., 1949.

A new defrosting indicator for frozen foods is described. Its action depends on the melting of a compound containing a red dye, and diffusion of the compound along a strip of filter paper as the package defrosts. At about the time of complete defrosting the red color reaches a visible position. The indicator can be adjusted to react at lower temperatures. The device is simple in design, practical in application, and inexpensive to manufacture.

*A METHOD OF MINIMIZING SUPERCOOLING AND ITS APPLICATION IN THE DETERMINATION OF FREEZING POINTS FROM DIELECTRIC CONSTANT MEASUREMENTS. T. M. Shaw, Rev. Sci. Instruments 13(1):2-5, Jan., 1942.

Determination of freezing points of water in colloidal systems from dielectric constant measurements is shown to be unsatisfactory when supercooling occurs. A method is described for minimizing supercooling, which makes possible accurate determinations of freezing point. Data showing freezing points obtained for a Barnes soil at various moisture contents are included.

HIGH FREQUENCY-HEATING CHARACTERISTICS OF VEGETABLE TISSUES DETERMINED FROM ELECTRICAL-CONDUCTIVITY MEASUREMENTS. T. M. Shaw and J. A. Galvin, Proc. Inst. Radio Engrs. 37(1):83-86, Jan., 1949.

Reports electrical conductivity of potato, carrot, apple, and peach at 25°C. for frequencies between 10^3 cycles per second and 4×10^7 cycles per second and electrical conductivity of potato at 3×10^7 cycles per second for temperatures between -80° and +30°C. These data are discussed in relation to industrial applications of the high-frequency heating method in the food and pharmaceutical industries.

AN ADAPTABLE STAINING SCHEDULE FOR PLANT TISSUE. R. M. Reeve, Stain Technol. 23(1):13-15, Jan., 1948.

A general schedule for meristematic, maturing, and mature plant tissues is described. Treatment with a dilute aqueous solution of Delafield's hematoxylin is followdd with staining in 0.1 percent safranin in 60 percent alcohol. Destaining of safranin may be partly accomplished in alcohol and completed by counterstaining with dilute fast green in a xylene and alcohol mixture. Various modifications and adaptations are briefly discussed.

FLASH HEAT. A. H. Brown, M. E. Lazar, T. Wasserman, and W. D. Ramage, Food Packer 32(1):20-21, 38-40, 42, 44, Jan., 1951; 32(2):34-5, Feb., 1951.

The steam injection heater and combination evaporator described are under study at this Laboratory as processing devices. Tests made to date indicate that the devices are highly flexible and useful processing tools, especially in food industries.

RAPID HEAT PROCESSING OF FLUID FOODS BY STEAM INJECTION. A. H. Brown, M. E. Lazar, T. Wasserman, G. S. Smith, and M. W. Cole, Indus. and Engin. Chem. 43 (12):2949-2954, Dec., 1951.

Experimental studies on publications of a direct steam-injection heater in processing fluid foods, such as fruit and vegetable purees and milk, have shown that pasteurization, sterilization, enzyme inactivation, and deodorization are among results that can be achieved. Important advantages are a minimum of fouling of surfaces and high speed of heating.

PACKAGING

*ARE YOUR CARTONS MOISTURE-PROOF? W. Rabak, West. Canner and Packer 33(11):52-55, Oct., 1941.

Reports a series of experiments which indicate that wraps and liners, not package types, prevent weight loss and hence protect color and quality of frozen peas.

*PACKAGING OF FROZEN FOODS UNDER WAR CONDITIONS. H. C. Diehl and W. Rabak, Proc. Inst. Food Technol., pp. 117-120, 1942.

Efficient packaging to guard against loss of moisture and oxidative changes in frozen foods and thus insure quality retention is discussed. Glazing is suggested as one important means of retaining quality.

*EFFECTS OF HEAT SEALING ON WATER-VAPOR PERMEABILITIES OF COATED CELLOPHANES. W. Rabak and G. L. Dehority, Modern Packaging 17(7):161-163, March, 1944.

Emphasizes destructive effects of high temperatures upon coatings and their erratic behavior, possibly due to impairment. Efficiencies of these cellophanes were not impaired by a one-second contact between sealing jaws at 385°F. This indicates that the lowest sealing temperature commensurate with firm bonds is desirable. Because coatings vary in behavior during sealing, it is desirable to adjust temperatures to coating types. A sealing temperature of 450°F. was markedly destructive to the three cellophanes, in one case increasing permeability of the heat-modified area 60 times over that of an equivalent area of the untreated sheet.

*THE PROTECTIVE PACKAGING OF FROZEN FOODS. W. Rabak, Refrig. Engin. 48(5):Nov., 1944; Good Packaging 6(2):21, Feb., 1945.

Discussion of factors influencing moisture permeability, material and types, quality retention, specialized packages, and a new method of packaging frozen foods.

*IMPACT--EFFECT ON MOISTURE BARRIERS AT LOW TEMPERATURE. W. Rabak and J. B. Stark, Modern Packaging 18(8):137-139, 166, April, 1945.

Commercial paraffin-base coatings were more nearly impervious to moisture vapor before subjection to impact tests than any of four commonly employed heat-sealing over-wrapping materials. Standardized impact test at 70°F. caused greater impairment of the sheet-material overwraps than of the dip-coatings. The efficiencies of both the overwraps and the commercial dip-coatings (except coating D) were seriously impaired by impact tests at 0°F.

PRACTICAL EXPERIMENTS DEMONSTRATE PROTECTIVE VALUE OF DOUBLE WRAP. W. Rabak and J. B. Stark, West. Canner and Packer 38(11):74-75, Oct., 1946; Food Indus. 18(11):1680-1691, Nov., 1946.

Experiments demonstrate that the double over-wrap increases barrier effect. This is particularly obvious in the instance of waxed paper, which resulted in a five-fold increase in water-vapor resistance. Efficiency of cellophane overwrap was increased three-fold. Although this increase may be due in part to offset points or areas of leakage, it is probable that transference of coating from one sheet to another in fluid state during heat sealing is also involved.

SEALING TEMPERATURE AND WVP--A CORRELATION IN EFFECTIVENESS OF WAXED PAPERS. W. Rabak and J. B. Stark, Modern Packaging 19(8):157-160, April, 1946.

Heat sealing definitely impairs water-vapor resistance of waxed papers. Heat sealing definitely impairs water-vapor resistance of waxed papers. Extent increases with elevation of sealing temperature. A temperature of 200°F. is less destructive to water-vapor resistance than 225 and 450°F. The latter is excessively destructive. Tests showing that machine-sealed overwraps are not as efficient as controlled hand-sealed overwraps indicate necessity for improvement of mechanical heat-sealing mechanisms. The starch-iodide impregnation method visually demonstrates effect of varying sealing temperatures on porosity of paraffin-coated papers.

PROTECTIVE PACKAGING IN FREEZING. W. Rabak, Quick Frozen Foods 9(6):68-69, 122, Jan., 1947; Modern Packaging 20(6):112-115, 164, Feb., 1947.

A discussion of protective packaging methods, including dip-coating and emphasizing importance of tight sealing to prevent desiccation, off-flavor developments, and vitamin destruction.

*PROTECTIVE PACKAGING OF FROZEN FOODS. J. G. Woodroof (Georgia Agri. Expt. Sta., Experiment, Ga.) and W. Rabak, Refrig. Engin. 57(1):49, Jan., 1949.

An up-to-date revision of the information published in Refrigerating Engineering Application Data 34 (published in November, 1944).

*WHAT'S WRONG WITH YOUR PACKAGE? W. Rabak, Frosted Food Field 9(2):6, Aug.,1950.
8 Discusses importance of tightly sealed containers for frozen food locker storage. Describes advantages of dip-coating method of packaging.

*PROTECTIVE PACKAGING WITH MOLTEN THERMOPLASTICS. W. Rabak, Amer. Management Assoc. Packaging Series 35, 16-20, 1950. Thermoplastic dip coatings of plasticized microcrystalline paraffin have been found to provide a dependable shatterproof protective covering for frozen foods, which is water-vapor resistant and essentially airtight.

FROZEN COOKED FOODS

AIC-10, FROZEN PORK AND BEANS OF THE TOMATO SAUCE TYPE. June, 1943.

FREEZING BAKED BEANS AND OTHER PREPARED FOODS. D. G. Sorber, Quick Frozen Foods 5(8):18-19, 24, 1943.

Report of work done on freezing baked beans. Aspects of preparation, evaluations of color and flavor, nutritional value, and storage behavior are discussed.

PREPARATION AND STORAGE OF FROZEN COOKED POULTRY AND VEGETABLES. H. L. Hanson, H. M. Winegarden, M. B. Horton, and H. Lineweaver, Food Technol. 4(11):430-34, Nov., 1950.

Results are reported on studies of frozen cooked foods containing turkey and chicken along with sauces and vegetables, including peas, carrots, celery, lima beans, corn, snap beans, green pepper, and mushrooms. Simmering and pressure cooking have proved superior to roasting for creamed turkey products. Older chickens produce more flavorful products than younger. Packaging is very important.

FROZEN COOKED RICE. I. POLISHED RICE. M. M. Boggs, C. E. Sinnott, O. R. Vasak, and E. B. Kester, Food Technol. 5(6):230-232, June, 1951; Rice Jour. 54(9):12, 14, 16, Sept., 1951.

Frozen cooked rice was prepared by slowly boiling the rice in a small amount of water for 10 minutes and then steaming for an additional 25 minutes, air cooling, packaging in cellophane, and freezing. Polished Texas Patna and California Pearl rice were used. Tasters found the products fully equal to freshly cooked rice, even after 8 months of storage at 10°F. Estimates of manufacturing costs indicate that a 12-oz. carton can be sold at retail for about 13 to 15 cents.

PREPARATION OF STABLE FROZEN SAUCES AND GRAVIES. H. L. Hanson, A. Campbell, and H. Lineweaver, Food Technol. 5(10):432-40, Oct., 1951.

Study of effects of conditions and substances has provided information on factors that affect stability of sauces and gravies subjected to freezing storage conditions. Varying degrees of improvement in stability were obtained but use of waxy rice flour as the thickening agent gave the most satisfactory sauce.

SANITATION

AIC-120, SANITATION OF FROZEN FOODS. July, 1946.

*SANITATION IN FROZEN FOODS. J. A. Berry, Frozen Food Indus. 4(11):10, 19, Nov., 1948.

A discussion of the precautions to be taken during food processing in order to obtain products of low bacterial count.

*DIRECT MICROSCOPIC METHOD TO ESTIMATE SANITARY HISTORY OF FROZEN PACK PEAS. E.R. Wolford, West. Canner and Packer 35(13):58, Dec., 1943.

Enumerates advantages of direct test over plate-count or cultural method for frozen food products. (See abstract under Vegetables--Peas.)

*THE FEWER THE BACTERIA, THE BETTER THE FROZEN PACK. J. A. Berry, Canner 94(4): 13-14, 1941.

Describes food spoilage as produced by bacteria and other micro-organisms, sources of contamination, significance of bacterial counts, and kindred topics.

*FROZEN FOODS HAVE GOOD HEALTH RECORD. J. A. Berry, Quick Frozen Foods 6(3):46, 1943. A semitechnical article, pointing out that frozen foods have not been nor are likely to be responsible for any outbreak of food poisoning.

* PROPIONATES CONTROL MICROBIAL GROWTH IN FRUITS, VEGETABLES. E. R. Wolford and A. A. Andersen, Food Indus. 17(6):622-624, June, 1945.

Interest in chemical compounds that check microbial growth has led to use of several preservatives in food products and also to research on their mode of action and their effect on foods. Data are presented to show that propionate treatment of figs and berries appreciably retards development of mold. Treatment of shelled peas and lima beans maintains quality longer during delay between harvest and processing. Effect varies with pH.

STUDIES ON CLOSTRIDIUM BOTULINUM IN FROZEN PACK VEGETABLES. H. Perry, C. T. Townsend, A. A. Andersen, and J. A. Berry, Food Technol. 2(3):180-190, July, 1948. (See abstract under Vegetables.)

DEHYDROFREEZING--FRUITS AND VEGETABLES

DEHYDROFREEZING--NEW WAY OF PRESERVING FOOD. L. B. Howard and H. Campbell, Food Indus. 18(5):674-676, May, 1946.

Experiments with several fruits and vegetables have shown that moderate dehydration (removal of about two-thirds of water content) followed by freezing storage resulted in excellent products in most cases. Advantages of this new method are savings in weight, space, packaging materials, and refrigeration load. The preliminary experiments have dealt with potatoes, peas, carrots, asparagus, cherries, boysenberries, and apricots.

PROCESS FOR PRESERVING FOODS. Patent No. 2,477,605 to L. B. Howard, W. D. Ramage, and C. L. Rasmussen, patented Aug. 2, 1949.

Relates to the dehydrofreezing process for preserving foods wherein the food is first partially dehydrated and then frozen.

QUALITY RETENTION THROUGH DEHYDROFREEZING. R. R. Legault and W. F. Talburt, Refrig. Engin. 57(12):1175-1177, Dec., 1949.

A general description of investigations in the field of dehydrofreezing of fruits and vegetables in the Western Regional Research Laboratory, including recent extensive research on peas and apples.

DEHYDROFROZEN APPLES. W. F. Talburt, L. H. Walker, and M. J. Powers, Food Technol. 4(12):496-98, Dec., 1950. (See abstract under Fruit.)

DEHYDROFROZEN PEAS. W. F. Talburt and R. R. Legault, Food Technol. 4(7):286-91, July, 1950. (See abstract under Vegetables--Peas.)

FROZEN FOOD LOCKERS AND HOME FREEZERS

*TECHNOLOGICAL ASPECTS OF LOCKER PLANT INDUSTRIES. H. C. Diehl, Quick Frozen Foods: I. 3(7):16-17, 1941; II. 3(8):24, 37-38, 1941.

Emphasizes importance of locker plant in food conservation, increasing use, relationship to frozen foods industry, necessity for uniform 0°F. or slightly lower temperature, significance of sharp freezing facilities and plant improvement, desirability of dispensing information to patrons regarding preparation of raw materials and use of frozen materials, value of uniform practice in locker industry, and need for a uniform, clearly objectified policy for the industry as a whole.

*PRESERVING FRUITS AND VEGETABLES IN FROZEN FOOD LOCKERS. J. A. Berry, West. Canner and Packer 34(4):50-52, 1942.

Deals with selection, preparation, and freezing of chief fruits and vegetables suitable for preservation in cold storage lockers.

FREEZING TO PRESERVE HOME GROWN FOODS. H. C. Diehl and K. F. Warner. U.S.D.A. Circ. 709, 62 pages, 1945.

Directions for preparation, storage, and handling of meats, poultry, eggs, fish, game, butter, vegetables, and fruits, particularly for locker patrons and users of home freezing cabinets.

FRUITS, GENERAL

PRODUCTION AND FOOD USES OF FRUIT. R. R. Legault and C. L. Rasmussen, U.S. Dept. Agr. Yearbook, 1950-51, pages 247-50.

United States and world production of fruits are described. Chemical composition, nutritive values, and processing problems of fruits are reviewed briefly.

PRESERVATION OF FRUITS BY FREEZING. W. Rabak, U.S. Dept. Agr. Yearbook, 1950-51, pages 277-80.

The history of technological developments that have advanced the commercial freezing preservation of foods is outlined by the author.

*FROZEN FRUITS AVAILABLE. D. G. Sorber, Ice Cream Field Year Book, 1942.

Presents material on availability of frozen fruits and their suitability for use in ice creams and sherbets.

*AN ANALYSIS OF THE FROZEN FRUIT INDUSTRY IN UTAH. D. G. Sorber, Farm and Home Science 5(2):1, June, 1944.

Presents economic background of the frozen-food industry, some significant trends to date of writing (1944), and an analysis of the industry in Utah. Fruits treated are apples, apricots, sweet cherries, pears, plums, prunes, blackberries, gooseberries, raspberries, and strawberries. Prices paid for these fruits are briefly discussed in terms of average prices (1927-1942) and medium prices.

*FROZEN, SLICED, CRUSHED, AND PUREED FRUITS. D. G. Sorber, Canner 94(7):16-17, 1942; 94(8):18, 1942.

Part I of this paper comprises a discussion of basic factors involved in preserving in sliced, crushed, and pureed fruit the natural fresh-fruit flavor and color through the freezing process. Varietal characteristics, maturity at harvest, transportation, storage, and precooling are dealt with; the preparation of fruit, the contaminative effect of certain metals, and fundamentals of packaging are presented. Part II discusses actual freezing operation, including methods of freezing, rate of freezing, storage temperature, and defrosting. The paper concludes with a discussion of chief uses of frozen fruits prepared in the various forms specified by the title.

TREATMENT OF FRUITS TO PREVENT BROWNING. Patent No. 2,475,838 to G. Johnson and D. G. Guadagni, patented July 12, 1949.

Fruits, such as peaches or apricots, are dipped in an aqueous solution, containing salt, ascorbic acid, and sodium bisulphite prior to freezing. By this method browning of the fruit is prevented.

AIC-166, CATECHOL TEST FOR FROZEN FRUITS. Dec., 1944.

CATECHOL TEST FOR FROZEN FRUITS. J. D. Ponting, Quick Frozen Foods 7(5):31, Dec., 1944.

Darkening of fruits has long been a source of annoyance to many frozen fruit packers. Fruits that discolor readily, such as apples, apricots, and peaches require pretreatment with a scald, sulfur dioxide or other treatment before they are frozen as a means of inactivating enzymes that cause discoloration. Reduction of enzyme activity controls darkening of fruit flesh before freezing, during frozen storage, and after the fruit is defrosted. The catechol test is generally applicable in determining effectiveness of scalding (with steam or hot water) since in this case the enzyme usually must be completely inactivated before fruit is frozen to prevent browning when it is defrosted. The test is useful in comparing effectiveness of various treatments for inactivation of oxidizing enzymes in fruits.

AIC-35, DETERMINATION OF ASCORBIC ACID IN FRESH, FROZEN, AND DEHYDRATED FOODS, Dec., 1943.

* ASCORBIC ACID. RAPID DETERMINATION IN FRESH, FROZEN, OR DEHYDRATED FRUITS AND VEGETABLES. H. J. Loeffler and J. D. Ponting, Indus. and Engin. Chem., Analyt. Ed. 14(11):846-849, 1942.

Ascorbic acid can be determined quickly in fruits and vegetables, whether fresh, frozen, or dehydrated, by disintegrating sample with dilute metaphosphoric acid in high-speed cutter and measuring decolorizing effect of the extracted ascorbic acid on indophenol dye with a photoelectric colorimeter. The ascorbic acid is distributed within the total liquid phase present, which includes the water and dissolved solids originally in the sample. Hence by using large proportion of extractant and knowing the approximate amount of liquid in the sample, ascorbic acid can be determined from as little as 3 ml. of filtrate after one extraction. By use of a large amount of 1 percent metaphosphoric acid as extractant the buffering step is avoided, since pH obtained is sufficiently low to prevent losses during blending, yet sufficiently high to prevent fading of the dye reagent. Rapid determinations can be made easily on highly pigmented berries and tough dehydrated vegetables.

*EXTRACTION OF ASCORBIC ACID IN PLANT MATERIALS. RELATIVE SUITABILITY OF VARIOUS ACIDS. J. D. Ponting, Indus. and Engin. Chem., Analyt. Ed. 15(6):389-391, June, 1943.

The stabilization of ascorbic acid during its extraction and determination has long been a problem. Of the 13 acids compared as to stabilizing effect on ascorbic acid solutions under conditions favorable to oxidation, only metaphosphoric and oxalic acids appeared suitable, these two acids being far superior to any of the others and about equally satisfactory. It is concluded that oxalic acid may be safely substituted for metaphosphoric acid in the determination of ascorbic acid, thus providing a more stable, more easily obtainable, and less expensive extractant.

*DETERMINATION OF SULFUR DIOXIDE IN FRUITS. J. D. Ponting and G. Johnson, Indus. and Engin. Chem., Analyt. Ed. 17(11):682-686, Nov., 1945.

Sulfur dioxide content of frozen fruits and other types of fruit can be determined rapidly by extraction, blending in buffered sodium chloride solution (which stabilizes sulfur dioxide against enzymic and autoxidation), and acidification and titration with iodine, with and without added formaldehyde, which binds sulfur dioxide.

*"FONDANT-LIKE" FORMATION ON FRUITS CAUSED BY CRYSTALLIZATION OF SUCROSE. W. Rabak and H. C. Diehl, West. Canner and Packer 36(4):55, April, 1944.

Conclusions were that fondant-like formation so frequently encountered in commercially stored frozen "sugar-pack" fruits is due primarily to crystallization of sucrose from the pack. The peculiar "mold-growth" appearance is in all probability due to the slow crystallization of sucrose influenced by conditions not now clearly understood.

SUCROSE HYDRATES; THE SUCROSE-WATER PHASE DIAGRAM. F. E. Young and F. T. Jones, Jour. Phys. and Colloid Chem. 53(9):1334-1350, Dec., 1949.

The sucrose-water system has been investigated by warming curves, solubility measurements, and microscopy. Two crystalline hydrates of sucrose have been isolated and identified as sucrose hemipentahydrate ($C_{12}H_{22}O_{11}.2\frac{1}{2}H_2O$) and sucrose hemiheptahydrate ($C_{12}H_{22}O_{11}.3\frac{1}{2}H_2O$). Two additional solid phases have been isolated and indications of several more have been obtained.

PREVENTION OF THE GROWTH OF SUCROSE HYDRATES IN SUCROSE SIRUPS. F. E. Young, F. T. Jones, and H. J. Lewis, Food Res. 16(1):20-29, Jan.-Feb., 1951.

Growth of sucrose hydrate in sucrose sirups was repressed by storage at -30° F.; it was also repressed at -10° F. by replacement of a portion of the sucrose by corn sirup, invert sugar, maltose, or levulose. Frequent spontaneous crystallization of dextrose would prevent its use as a sucrose hydrate inhibitor.

SUCROSE POLYHYDRATE GLAZING OF FRUIT. Patent No. 2,542,068 to F. E. Young and F. T. Jones, Feb. 20, 1951.

Fruit is coated with a suspension of sucrose polyhydrate crystals in sucrose sirup, then frozen. The frozen coating consists mostly of sucrose polyhydrate which is hard and so protects the fruit during storage and handling.

NEW FRESH-FRUIT SPREADS PRESERVED BY FREEZING. G. Johnson and M. M. Boggs, Food Indus. 9(11):1491-1494, Nov., 1947.

Two new gelled fruit products, which retain to a high degree fresh flavor and aroma and natural color of ripe fruit, are described. The high retention of fresh flavor is accomplished by preparing the product at room temperature and preserving it at 0°F. or lower. The new products are prepared with fresh or frozen fruit juice or puree, sugar, and pectin. They have a soluble solids content lower than that of jellies and jams.

COLD PROCESSED FRUIT SPREAD. Patent No. 2,459,431 to G. Johnson and M. M. Boggs, Patented Jan. 18, 1949.

Describes preparation of a gelled fruit product useful as a dessert or as a spread which retains the fresh flavor of the fruit. Retention of fresh fruit flavor is obtained by avoiding the elevated temperatures which are customary in production of ordinary jellies.

PREVENTION OF SUCROSE HYDRATE FORMATION IN COLD PROCESSED FROZEN FRUIT SPREADS. J. E. Brekke and W. F. Talburt, Food Technol. 4(10):383-86, Oct., 1950.

Three methods for prevention of sucrose hydrate in frozen fruit products were studied: control of storage temperature, hermetic sealing, and use of invert sugar as part of total sugar added. The latter two methods appeared to be effective, and -10°F. appeared to be more favorable for hydrate formation than lower or higher temperatures.

AIC-40 VELVA FRUIT--A NEW FROZEN FRUIT DESSERT. Rev. March, 1946.

Provides formulas and instructions for the manufacture of a frozen fruit dessert made of fruit puree, sugar and gelatin. The dessert retains the natural flavor of fresh fruit and has a texture similar to ice cream.

AIC-53 HOME PREPARATION OF VELVA FRUIT--A NEW FROZEN DESSERT. July, 1944.

AIC-239 TENTATIVE RECOMMENDATIONS FOR THE TREATMENT OF BERRY BOXES (HALLOCKS) TO REDUCE MOLD GROWTH. E. J. Barta and E. Lowe, June, 1949.

Tentative recommendations for the treatment of berry-picking boxes with paraffin waxes compounded in definite proportion are made. Treating conditions are specified. Patent:

AIC-270 APPLICATION OF WAX TREATMENT TO BERRY BOXES (HALLOCKS) TO CONTROL MOLDS. E. J. Barta and E. Lowe, April, 1950.

A successful method for the application of wax coating to berry picking boxes (called hallocks in the Northwest) is described. This coating is markedly beneficial in control of molds of picked fruit. A machine for application of the coating is described with suggested specifications. (Supersedes AIC-239)

TREATMENT OF BERRY BOXES (HALLOCKS) TO REDUCE MOLD GROWTH. Edward J. Barta, Everett R. Wolford and E. Lowe, Food Technol. 5(12)512-517, Dec., 1951.

Studies were made as a basis for recommendations on type of wax, dipping times, and dipping temperatures most suitable for treatment of berry picking boxes to control a growth of molds.

HISTOCHEMICAL TESTS FOR POLYPHENOLS IN PLANT TISSUES. R. M. Reeve, Stain Technol, 26(2), April 1951.

A satisfactory histochemical test for polyphenols in fresh plant tissue is described. The test is based upon a colorimetric method for phenolics using a nitrous acid reaction.

HEAT INACTIVATION OF POLYPHENOLASE IN FRUIT PUREES. K. P. Dimick, J. D. Ponting, and B. Makower, Food Technol. 5(6):237-41, June, 1951.

Thermal-inactivation characteristics of polyphenolase were investigated in purees of apples, apricots, peaches, pears, and grapes, to determine conditions for heat treatments required for prevention of enzymatic browning. Inactivation was measured as a function of time, temperature, and pH in a continuous-flow apparatus which allowed a part of the reaction to be studied under isothermal conditions.

PROCESS FOR PASTEURIZATION AND ENZYME INACTIVITY OF FRUITS BY ELECTRONIC HEATING. Patent No. 2,476,251 to T. L. Swenson, patented July 12, 1949.

Orange juice is prepared by subjecting whole oranges to a high-frequency

electrostatic field to pasteurize the juice and inactivate its enzyme content. The treated oranges are then cooled and the juice expressed therefrom.

Apples

AIC-57 COMMERCIAL PREPARATION AND FREEZING PRESERVATION OF SLICED APPLES. Aug., 1945.

Provides detailed instructions for two prefreezing processing methods for apple slices to prevent oxidative discoloration, namely sulfite dip and steam scalding.

TREATMENT OF APPLE SLICES FOR FREEZING PRESERVATION. D. G. Guadagni, Food Technol. 3(12):404-408, Dec., 1949.

Vacuum impregnation of apple slices with sugar sirups has been studied and the product of this prefreezing treatment has been compared with that from steam blanching and from sulfiting. Generally the product of sirup filling was equal or superior, but most improvement over other processes was noted in softer varieties. (Same process as described in AIC-253.)

LABORATORY STUDIES ON FACTORS AFFECTING LEACHING LOSSES DURING PROCESSING OF APPLES. A. M. Mylne and C. G. Seegmiller, Food Technol. 4(2) 43-46, Feb.,1950.

Apple slices were immersed in water and in solutions of sodium chloride, calcium chloride, and sulfur dioxide for varying times, followed by chemical analysis of leach liquid for total sugar. Leaching losses ranged from about 5 percent of sugar present in the apples (1 minute leach), to about 50 percent (24-hour leach).

ADAPTATION OF THE TENDEROMETER FOR THE QUANTITATIVE DETERMINATION OF FIRMNESS IN CALCIUM-TREATED APPLE SLICES. D. G. Guadagni, Food Technol. 4(8) 319-321, Aug., 1950.

Data presented show reliability of the tenderometer for measurement of firmness of cooked apple slices. Firmness values obtained by a simple test-cooking procedure reflected accurately the firmness obtained in actual pie baking. The method appears suitable for control work in calcium treatment firming apple slices.

AIC-253 SIRUP TREATMENT OF APPLE SLICES FOR FREEZING PRESERVATION. Anon., Sept., 1949.

Vacuum impregnation of apple slices with sugar sirups has been studied and the product has been compared with that from steam blanching and from sulfiting. Generally the product of sirup filling was equal or superior, but most improvement over other processes was noted in the softer varieties.

DEHYDROFROZEN APPLES. W. F. Talburt, L. H. Walker, and M. J. Powers, Food Technol. 4(12):496-98, Dec., 1950.

Dehydrofreezing, a new food processing technique combining the advantages of dehydration and freezing, has been satisfactorily applied to many of the leading Western apple varieties. Details on enzyme inactivation, drying temperatures, reduction of weight and volume, effects of variety and maturity, packing, and their advantages and adaptability to bakery and institutional uses are given.

AIC-293 FROZEN APPLE-JUICE CONCENTRATE: APPLICATION OF LABORATORY DATA TO PROSPECTIVE COMMERCIAL OPERATIONS. V. F. Kaufman, C. C. Nimmo and L. H. Walker, Nov., 1950.

A method for commercial production of a full-flavored apple-juice concentrate is proposed on the basis of laboratory data. The important processing steps are discussed, a flow sheet is presented, and estimates of probable plant investments and processing costs are given.

PREPARATION OF FROZEN APPLE-JUICE CONCENTRATE. L. H. Walker, C. C. Nimmo, and D. C. Patterson, Food Technol. 5(4):148-51, April, 1951.

Three methods for preparation of full-flavored apple juice concentrate are presented and the products compared organoleptically. Data indicate that concentration can be carried out in relatively low-cost vacuum pans without affecting flavor of product.

COSTS AND METHODS FOR PIE-STOCK APPLES. Vern F. Kaufman, Food Eng. 23(12): 97-105, Dec., 1951.

Comparative costs are estimated for eleven commercial and experimental apple products that can be used by bakeries in making pies. Cost estimates cover processing, storage, transportation, and distribution.

Avocados

AIC-305 A NEW FROZEN AVOCADO PRODUCT. R. J. McColloch, B. W. Nielsen and E. A. Beavens. West. Canner and Packer, 43(8):32-33, July, 1951, Quick Frozen Foods, 14(2):56-7, Sept., 1951.

A frozen avocado product for commercial handling has been developed by modification of formulas for "guacamole." The modification requires addition of sufficient acid, in the form of lemon juice, to reduce the pH of the product to 4.5 or below. Such a product retains its light green color and desirable flavor in frozen storage at least one year.

Cranberries

HOW JELLIED CRANBERRY SAUCE IS PRESERVED BY FREEZING. M. M. Boggs and G. Johnson, Food Indus. 19(8):1067-1069, Aug., 1947.

A method of preparing jellied cranberry sauce, without extensive heating, and preserving it by freezing temperature. Freezing weakened gel structure and accentuated syneresis of the gels if prepared without added pectin. Frozen gels, containing 0.25 to 0.35 percent rapid-set, high grade, citrus pectin, were entirely satisfactory in strength and syneresis. The fact that only 50 percent of the added pectin was precipitated under the sugar and pH conditions probably accounted for the decreased syneresis. All rapid-set, citrus pectins tried were satisfactory. Results were not uniform when rapid-set, apple pectin, or slow-set apple and citrus pectins were used.

Oranges

CONDITION OF ORANGES AS AFFECTING BACTERIAL CONTENT OF FROZEN JUICE WITH EMPHASIS ON COLIFORM ORGANISMS. E. R. Wolford and J. A. Berry, Food Research 13(2):172-178, March-April, 1948.

Juice prepared experimentally from "soft-rot" Valencia oranges was found to contain a microbial population approximately 2,500 times as great as juice similarly prepared from sound fruit. The coliform content was also much greater. Elimination of unsound fruit is extremely important in the production of frozen orange juice of low microbial content and coliform index.

BACTERIOLOGICAL STUDIES ON COMMERCIALLY PREPARED FROZEN ORANGE JUICE STORED AT -10°F. E. R. Wolford, Food Technol. 4(6):241-256, June, 1950.

Plate counts of frozen orange juice followed over a 43-week storage period decreased in a roughly logarithmic manner. Between the second and forty-third week, indices of coliforms varied from sample to sample and showed no definite downward trend. Most were Aerobacter species but some resembling Escherichia coli were found.

Peaches

ENZYMATIC OXIDATION OF PHENOLIC COMPOUNDS IN FROZEN PEACHES. D. G. Guadagni, D. G. Sorber, and J. S. Wilbur, Food Technol. 3(11):359-364, Nov., 1949.

Methods are presented for quantitative estimation of rate and extent of enzymatic browning in frozen peaches. Degree of browning in several peach varieties was found to be directly related to the amounts of oxidizable tannins present.

Strawberries

RETENTION OF ASCORBIC ACID IN STRAWBERRIES DURING PROCESSING, FROZEN STORAGE, AND MANUFACTURE OF VELVA FRUIT. H. J. Loeffler, Food Res. 11(1):69-83, Jan., Feb., 1946.

Presents data of use in manufacture of Velva Fruit. Effects of condition of fruit, of freezing, of freezing and short storage, of extended storage, and of defrosting were studied in relation to retention of ascorbic acid in sugared and unsugared puree.

VEGETABLES, GENERAL

*Some fundamentals of vegetable preservation by freezing. H. Campbell, West. Frozen Foods 1(8):3-5, June, 1945.

Emphasizes necessity for high and uniform levels of quality if progress made in vegetable preservation by freezing is to be maintained. The author discusses raw materials from standpoint of variety, source, maturity, and handling. Under processing methods he treats blanching, cooling, and freezing procedure. Storage practices are discussed with reference to temperature and stacking. The hazards are pointed out and means of avoidance are provided.

NINE PRINCIPLES FOR FREEZING VEGETABLES. J. A. Berry and F. E. Lindquist, U.S. Dept. Agr. Yearbook, 1945-47, pages 217-20.

The nine principles apply to steps in freezing from selection of raw materials to storage of packed product.

RAPID DETERMINATION OF STARCH IN VEGETABLES. J. P. Nielsen, Indus. and Engin. Chem., Analyt. Ed. 15(3):176-179, March, 1943.

In certain vegetables such as peas, corn, and lima beans, the starch content of the seed tends to increase as the plant matures. This increase is usually associated with a decrease in total sugar and tenderness. A rapid and reasonably accurate method for determination of starch in certain vegetables has been developed. It includes grinding fresh sample, extracting starch with perchloric acid, and estimating by photoelectric colorimeter the dissolved starch indicated by the blue color produced with iodine. Alcohol extraction of products studied was found unnecessary. Use of red filter in colorimeter considerably reduces error produced by dextrins when present.

*DETERMINATION OF CRUDE LIPID IN VEGETABLE MATTER. J. P. Nielsen and G. S. Bohart, Indus. and Engin. Chem. 16(11):701-703, Nov., 1944.

Sweet corn and other vegetables increase in lipid content as they mature and a simple method for determination of crude lipid might serve as an index of maturity. Complete procedure including preparation of sample can be carried out in a short time. The method yields considerably larger quantities of crude lipid from certain types of vegetable material such as immature seeds than do the commonly accepted procedures for crude fat. It is equally well adapted to wet or dry ground products.

TENDERIZING VEGETABLES FOR FREEZING. J. P. Nielsen, H. Campbell, and M. Boggs, West. Canner and Packer 35(6):49, June, 1943.

Experiments reported in this paper show blanching in solution of sodium hexametaphosphate to be an effective method of tenderizing.

STUDIES ON CLOSTRIDIUM BOTULINUM IN FROZEN PACK VEGETABLES. H. Perry, C. T. Townsend, A. A. Andersen, and J. A. Berry, Food Technol. 2(3):180-92, July, 1948.

The possibility of toxic spoilage of frozen pack vegetables was investigated. The authors report failure of a wide variety of frozen vegetables to become toxic when thawed and held at room temperature for 2 days. Data presented yield no evidence that hermetically sealed containers would introduce a public health hazard if used in freezing preservation of vegetables.

Blanching

AIC-34, A TEST FOR ADEQUACY OF BLANCHING IN FROZEN VEGETABLES. Revised May, 1947.

RAPID ESTIMATION OF PEROXIDASE IN VEGETABLE EXTRACTS--AN INDEX OF BLANCHING ADEQUACY FOR FROZEN VEGETABLES. M. P. Masure and H. Campbell, Fruit Prod. Jour. and Amer. Food Mfr. 23(12):369-374, Aug., 1944.

A simple and rapid colorimetric method for quantitative estimation of peroxidase activity in vegetable extracts. Values obtained show correlation with degree of blanch in stored vegetables preserved by freezing. The quantitative method has been modified to provide a simpler, semi-quantitative test for plant use.

Brussels Sprouts

EFFECT OF ENZYME INACTIVATION ON QUALITY RETENTION IN FROZEN BRUSSELS SPROUTS. F. E. Lindquist, W. C. Dietrich, M. P. Masure, and M. M. Boggs, Food Technol. 5(5):198-199, May, 1951.

Peroxidase but not catalase activity serves as a satisfactory index for the adequacy of blanching of Brussels sprouts. Samples containing active peroxidase when held at -10°F. for 10 months were found to have a marked off-flavor, decreased natural flavor, and an abnormal pink color at the centers.

Corn

WHICH MATURITY INDEX METHOD BEST FOR RAW SWEET CORN? G. H. Carter, O. E. Olson, and J. L. Henry (Laboratory of Fruit and Vegetable Products, Pullman, Wash.), Food Packer 31(9):44-46, Sept., 1950.

In a study of several methods of determination of maturity of sweet corn, refractive index was found to be the most rapid, accurate, and useful.

QUICK TEST OF SWEET CORN QUALITY. K. T. Williams, E. A. McComb, and B. L. Washauer, Food Indus. 22(3):458-459, March, 1950.

A rapid method for determination of moisture in sweet corn consists of grinding the corn, reacting a sample with calcium carbide, determining loss of acetylene formed by loss in weight, and calculating the water equivalent of the acetylene.

*SCALDING OF CUT CORN FOR FREEZING. H. Campbell, West. Canner and Packer 32(9): 51-53, Aug., 1940.

Primary purpose underlying scalding of corn is, of course, to inactivate enzymes which otherwise would bring about off flavors, odors, and colors during storage. Because little seemed to be known relative to minimum scalding requirements for cut corn, experiments were undertaken to determine this point.

EFFECT OF PROCESSING PROCEDURE ON QUALITY OF FROZEN WHOLE-KERNEL SWEET CORN. F. E. Lindquist, W. C. Dietrich, and M. M. Boggs, Food Technol. 5(9):381,Sept.1951.

Two types of blanching procedure, blanching on the cob prior to cutting and blanching of cut kernels, have been compared with regard to effect on quality of frozen whole-kernel sweet corn. Data show that blanching on cob prior to cutting results in higher-quality frozen product and increased yield.

COMPARISON OF SCORING RESULTS FOR TWO AND FOUR SAMPLES OF CORN PER TASTE SESSION. A. C. Ward and M. M. Boggs, Food Technol. 5(6):219-20, June, 1951.

Four samples of frozen corn that differed only slightly in flavor were scored with two and also with all four samples in single taste sessions. Judges did not consistently show better performance with two than with four samples.

Lima Beans

*PROTEIN AND SULFUR CONTENT OF IMMATURE LIMA BEANS AS AFFECTED BY VARIETAL AND ENVIRONMENTAL FACTORS AND PROCESSING. M. E. Davis, E. M. Chace, and D. G. Sorber (with Univ. Calif.). Food Res. 7(1):26-37, 1942.

Concerned with protein and sulfur contents of green lima beans as affected by hereditary and environmental factors. There is slight change in the nitrogen and sulfur fractions of the total solids because of removal of white, immature beans or because of blanching, freezing, and drying processes.

Peas

ONTOGENY OF THE SCLEREIDS IN THE INTEGUMENT OF PISUM SATIVUM L. R. M. Reeve, Amer. Jour. Bot. 33(10):806-816, Dec., 1946.

Detailed histological account of development of sclereids of peas is given. Structural changes involve changes in composition of cell wall materials and middle lamellae. Maturity stages ranging from extremely immature, through succulent stages used in freezing are included in these studies.

RELATION OF HISTOLOGICAL CHARACTERISTICS TO TEXTURE IN SEED COATS OF PEAS. R. M. Reeve, Food Res. 12(1):16-23, Jan., 1947.

Major causes of texture change during maturation is formation of specialized cell walls in epidermal cells (sclereids). Other structures and their significance to texture and maturity are discussed. Brief experiments on mineral nutrition showed that (without change in skin thickness) plants grown in high Ca (low K) produced peas with skins tougher than those from control plants, and plants grown in low Ca (high K) produced peas with skins more tender than those of control. Definition and distinction between inherent and environmental factors of texture is made on a histological basis.

HISTOLOGICAL OBSERVATIONS ON THE SEED COATS OF SUCCULENT PEAS. R. M. Reeve, Food Research 14(1):77-89, Jan.-Feb., 1949.

A histological study of the development of peas during succulent stages, covering such phases as tissue digestion, distribution of starch grains and aldehydic materials, and methods of differentiation between aldehydes and peroxidase. It was suggested that some changes in flavor associated with delay between vining and processing may be due to natural processes of tissue resorption.

DEGREE OF MATURITY INFLUENCES THE QUALITY OF FROZEN PEAS. J. P. Nielsen, H. Campbell, G. S. Bohart, and M. P. Masure, Food Indus. I. 19(3):81-84, Mar.,1947; II. 19(4):103-106, April, 1947.

Part I: Sugar and fat determinations do not appear suitable as indexes of maturity. Protein and skin texture offer possibilities. Starch content shows promise of usefulness as an objective measure of maturity and texture. Part II: Total solids content and starch content are two good objective indexes of the maturity of peas. Limits are suggested for starch and total solids contents for fancy, extra standard, and standard grades.

*QUALITY IN FROZEN PACK PEAS. H. Campbell and H. C. Diehl, West. Canner and Packer 32(10):48-50, Sept., 1940; 32(11):51-53, Oct., 1940.

Factors that influence quality, maturity, handling, variations within pack, and standards for grades are discussed.

*DELAY AFFECTS FROZEN PEA QUALITY. J. P. Nielsen, E. R. Wolford, and H.Campbell, West. Canner and Packer 35(6):47-48, June, 1943.

This evaluation of losses in quality constituents in shelled peas delayed between harvest and freezing shows that, when peas are held at an average temperature of 76°F., serious losses do not occur in 4 hours, but that beginning at 8 hours there is rapid deterioration in sugar, vitamin C, flavor, and texture, accompanied by great increases in bacterial content. Peas delayed 12 hours at 76°F. are unfit to pack, and even an 8-hour delay is to be avoided. Use of ice or any other method of reducing temperature is strongly recommended during such delays and may be routinely necessary in many instances. A reduction in temperature of raw product, if only to 50°F., as in the work described, is of considerable benefit, especially in checking growth of bacteria which with natural respiration of product are, as is well known, responsible for loss of sugar and lack of fresh flavor.

TIME LAPSE GETS TOP BLAME FOR SHELLED PEA OFF-FLAVOR. W. F. Talburt and R. K. Legault, Food Indus. 22(6):1021-23, June, 1950.

Experiments reported have shown that off-flavor associated with delay between shelling and processing of fresh frozen peas is not due to vine juice, products of respiration, bacteria, or other external environmental factors.

ROLE OF BRUISING AND DELAY IN DEVELOPMENT OF OFF-FLAVOR IN PEAS. R. U. Makower and A. C. Ward, Food Technol., 4(2):46-49, Feb., 1950.

Organoleptic studies indicate that peas require both bruising and a period of delay to produce delay off-flavor and deterioration of texture and color. These effects occur in the absence of micro-organisms, are accentuated by increased bruising or delay, but are not produced by bruising alone, or delay alone (for 24-30 hours at 75°F.).

NOTES ON THE TENDEROMETER. H. Campbell, West. Canner and Packer 31(6):113-114, May, 1939.

Rapid growth of the frozen pea industry shows need for quality control and standardization. Discusses usefulness of tenderometer in grading peas.

*TEMPERATURE AND TENDEROMETER. HOW TEMPERATURE MAY AFFECT TENDEROMETER VALUE FOR PEAS. H. Campbell, West. Canner and Packer 34(2):39-40, Feb., 1942.

While work reported was preliminary, it seems apparent that temperature of peas may affect tenderometer values and is a factor which should be considered. Temperature effect points to desirability of standardized procedure wherein samples would be brought to a uniform temperature by tempering in water. Degree of hardness of water need not be considered.

*DIRECT MICROSCOPIC METHOD TO ESTIMATE SANITARY HISTORY OF FROZEN PACK PEAS. E. R. Wolford, West. Canner and Packer 35(13):58, Dec., 1943.

Enumerates advantages of direct test over plate-count or cultural method for frozen food products.

FACTORS INFLUENCING TEXTURE OF PEAS PRESERVED BY FREEZING. M. M. Boggs, H. Campbell, and C. D. Schwartze, Food Res. I. 7(4):272-287, July-Aug., 1942; II. 8(6):502-515, Nov.-Dec., 1943. (With Wash. Agr. Expt. Sta.).

Part I: The specific texture investigations reported are: (1) variation for a given sieve size and variety of peas grown in the same field and harvested on the same day; (2) variation for a given sieve size and variety of peas grown in the same field but harvested on different days of the same season; (3) effect of cooking for 5, 10, and 15 minutes; (4) effect of vining; (5) effect of delay between vining and freezing. Part II: Varieties suitable for freezing were grown under commercial conditions, vined, cleaned, scalded for 1 minute in water at 210°F., cooled in water to approximately 57.2°F., packaged in 12-ounce waxed-paper cartons, wrapped, and heat-sealed in moisture-vapor-proof cellophane, then frozen and stored at 0°F. After several months the peas were cooked without preliminary thawing in boiling water for 6 minutes, and texture of skins of all samples was determined by measuring load in kilograms required to penetrate 3 layers of skins with a 1/8-inch, steel, ball-bearing penetration point. In one study texture of cotyledon was also determined by measuring load required to crush one cotyledon to 1/4 of its thickness.

METHODS OF MEASURING TENDERNESS AND MATURITY OF PROCESSED PEAS. R. U. Makower, Food Technol. 4(10):403-408, Oct., 1950.

In peas the organoleptic quality known as "maturity" is measured most directly by trained human judges. The tenderometer for raw peas and alcohol-insoluble solids for processed peas are the best objective methods. Other less adequate methods and need for further methodological research are discussed.

MODIFIED FLOTATION METHOD SPEEDS FROZEN PEA MATURITY GRADING. R. G. Witebsky and H. K. Burr, Food Packer 32(6):36-37, June, 1951.

A modification of the Tentative United States Standard method for grading frozen peas is described. Sugar solutions are substituted for the conventional sodium chloride brines and entrapped air is eliminated by evacuation. Data are presented to show that the modified method gives essentially the same results as the present standard method.

THE SPLITTING OF SHELLED PEAS INTENDED FOR FREEZING. H. Campbell, West. Canner and Packer 32(8):49-50, July, 1940.

Presence of split and otherwise damaged peas materially detracts from appearance of frozen product, and, if severe, may constitute a grade defect. Data show that initial cause for excessive splitting of shelled peas seems to lie in improper viner operation. Since increase in splitting takes place on holding of peas in iced or uniced condition, it would seem that avoidance of delays would tend to reduce damaged peas in pack. Although scalding techniques may account for some splitting, their significance seems to be relatively unimportant; the advantage seems to be with steam scalding and, where water scalding is employed, at temperatures below or at 200°F.

EFFECT OF STORAGE TEMPERATURE ON QUALITY OF FROZEN PEAS. F. E. Lindquist, W. C. Dietrich, and M. M. Boggs, Food Technol. 4(1):5-9, Jan., 1950.

Carefully prepared samples of frozen peas were stored at -10°, 0°, and 10°F. The stored material was examined at intervals by experienced judges to determine rate at which changes occurred. Appraisal was made by the triangular plan and results were analyzed for significance.